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FM 4-5
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FIELD MANUAL
COAST ARTILLERY
TACTICS

CHANGES
NO. 1

WAR DEPARTMENT
Washington 25, D. C., 8 Aug., 1947

FM 4-5, 20 June 1944, is changed as follows:

2. COASTAL FRONTIER DEFENSE. (Superseded). **a.** Coastal frontier defense includes all measures taken by the armed forces to provide protection against any form of attack at or near the shoreline and within the zone immediately to the rear.

b. In the preparation for and the execution of coastal frontier defense, the basic consideration of the defending force is the defeat and destruction of the invading force before it lands or while it is attempting to gain a beachhead.

c. Coastal frontier defense is conducted by all elements of the armed forces: the Navy to meet and defeat the enemy while he is still at sea; the air forces to counter enemy air action and carry

the offensive to the enemy both at sea and on land; and the ground forces to meet and defeat the enemy prior to landing, while landing, or after he has landed.

d. Since the fleet and the air forces are offensive weapons, they must have secure bases from which to operate and must be freed from the necessity of protecting them. This makes necessary the presence of harbor, anchorage, and beach defense installations, which are integrated to form fortified localities. The base defense system is developed around these installations.

2.1. MISSIONS OF SEACOAST ARTILLERY.

(Added.) Seacoast artillery, which comprises the fixed and mobile seacoast weapons of a coastal frontier defense, has the primary mission of denying to the enemy all water areas within the range of its weapons. Seacoast artillery's secondary mission is to contribute as far as practicable—without neglect of the primary mission—to the landward and antiaircraft defenses. The basic elements of these two missions are to—

a. Protect a friendly fleet while at, entering, or debouching from its base.

b. Deny the enemy entrance to, or occupation of, a harbor or other critical water or land areas which might serve as a base for land and/or naval operations.

c. Hold beyond effective range hostile naval forces intent on supporting amphibious operations or on bombarding the vital area which the defending armament is installed to protect.

d. Prevent the passage of enemy naval vessels or commercial shipping through water areas covered by the field of fire of the armament.

e. Support ground troops in a defense of the area from a landward attack.

f. Contribute to the defense against air attack of the defended installations or surrounding areas.

g. Maintain observation of the coastal frontier and the sea beyond as far as practicable.

3. (Superseded.) To provide a basis of understanding and cooperation between the Army and the Navy in the employment of forces in coast defense, certain principles and terms have been jointly adopted. These principles and the definitions of these terms will be found in FM 31-5, FM 31-10, FTP-167 (Landing Operations Doctrine), FTP-211 (Ship to Shore Movement), FTP-155 (Joint Action of the Army and Navy), and JAN P-100 (Joint Amphibious Communication). For definitions of general military terms, see TM 20-205.

4. (Superseded.) a. The seacoast artillery commander in a permanent harbor defense is frequently the sub-sector commander within the coastal frontier defense organization. At the outbreak of hostilities, he seldom has enough troops at his command to establish a complete sub-sector all-around defense. Consequently, the seacoast

artillery may find itself alone in defending an area both from sea and land attack.

b. Against attack by naval forces only, the seacoast artillery usually acts alone, or in conjunction with air or naval forces. With the exception of air or naval forces, seacoast artillery is the only branch of the armed forces capable of attacking all types of hostile ships.

c. In beach defense and in the defense of harbors made the object of determined assault, normally seacoast artillery will act as a part of a force of all arms. In repulsing such attacks with landward fire, seacoast artillery will normally act as part of the field force artillery arm.

d. The relation between seacoast artillery and air and naval forces should be particularly close, as they engage in common offshore missions. Air and naval forces are important sources of information for seacoast artillery concerning the enemy naval situation.

7. Seacoast artillery is characterized by the—

* * *
e. Comparative invulnerability of its weapons to naval artillery fire when such weapons are casemated or turreted.

f. (Added.) Comparative invulnerability of its weapons to air attack when such weapons are casemated or turreted and properly supported by antiaircraft defenses.

8. Limitations of seacoast artillery are the—

* * * * *

d. (Added.) Vulnerability of its wire communications and fire control equipment, especially radar, to naval and aerial bombardment.

13. **SECONDARY ARMAMENT.** To supplement * * * considerations apply.

* * * * *

d. (Superseded.) Dual-purpose armament, such as 90-mm guns; is employed on such missions as attacking fast, unarmored vessels, protecting mine fields, and providing AMTB and AA defense.

e. (Added.) Antiaircraft automatic weapons provide local defense of positions against low-level air attack; they may also be used in beach defense and to supplement larger armament in attacking small vessels at short ranges.

24. Consideration should be * * * employment of weapons. All seacoast artillery may be given land missions to execute from their normal beach or harbor defense positions and mobile artillery may be required to occupy **supplementary** positions for this purpose. If employed in * * * shifting of fire. See FM 4-10 (when revised), 6-20, 6-40, and chapter 5.1 of this manual for details concerning firing on land targets.

26. In selecting sites * * * dispersal of elements. In figure 6, the battery ammunition dump houses the bulk of the ammunition on hand, and the bivouac area is for all battery personnel not actually on alert at the guns. Ready ammunition and shelters for the gun crews on alert will be at or near the guns.

Section I.I. (Added.) MANEUVERABILITY AND CHARACTERISTICS OF NAVAL VESSELS

46.1. GENERAL. Targets likely to be confronted in battle probably will be capable of high speed

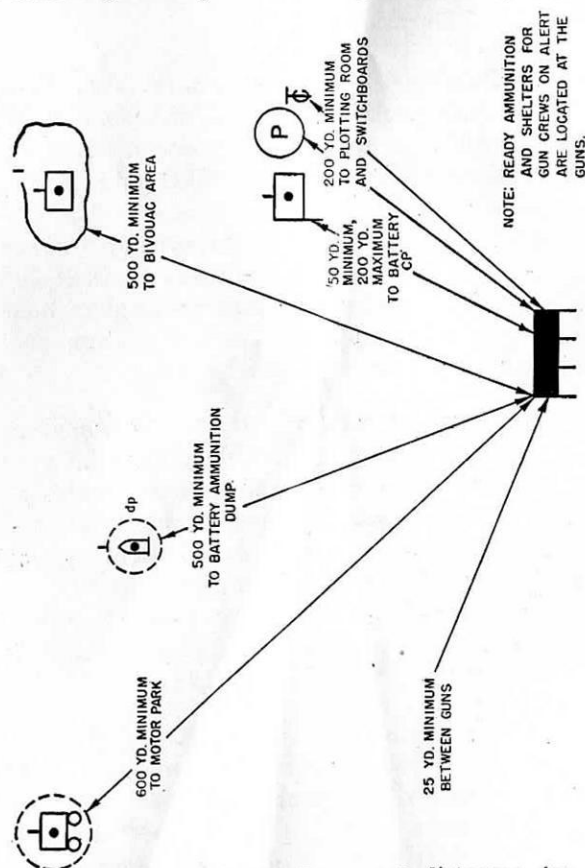


Figure 6. (Superseded.) Suggested distances for dispersal of elements of 155-mm seacoast artillery gun battery.

(exceeding 25 knots) and capable of sudden maneuvers. All seacoast artillery personnel should be aware of the maneuverability of naval vessels. While the data presented in this section are based on the performance of United States warships, the maneuvering characteristics of each type of naval vessel listed are sufficiently universal to make the data applicable to the ships of all nations.

46.2. WATER DEPTH. Vessels engaged in combat will avoid limited areas of navigable water as this will restrict their maneuverability. Seacoast artillerymen should be familiar with the depths of the surrounding water areas; this, together with the knowledge of water depths required for various ships to navigate, will enable artillery personnel to know where certain ships cannot navigate. Condition of tides must be considered because charts show soundings at mean low low water. Ranges of water depths required for navigation by the several types of combatant ships are as follows:

Type	Necessary water depth (feet)
Battleships	30 to 37
Aircraft carriers	25 to 35
Cruisers	16 to 26
Destroyers	14 to 19
Submarines (surfaced)	about 16
Submarines (awash)	about 20
Submarines (at maximum periscope depth)	about 60
Support type landing craft.....	6 to 12

While the above depths are those that are required for navigation, a ship in shallow water is slow in answering her rudder and tends to sheer to one side or the other; for this reason, as well as for allowing a reasonable safety factor against grounding, a ship can be expected to avoid shallows whenever possible.

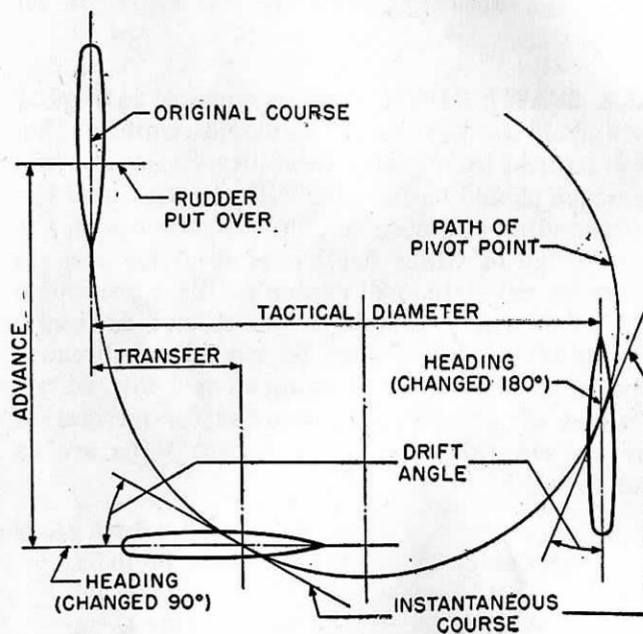


Figure 10.1. (Added.) Course of ship illustrating several naval terms.

46.3 MANEUVER. Although the amount of sea room needed by ships for maneuvering purposes varies with the type of ship, certain factors are common to all types. The principal method by

which a ship can be maneuvered is by use of the rudder. A ship will not respond immediately to a movement of the rudder but will begin a gradual turn with the stern of the vessel moving out in a direction away from that in which it is desired to go. Once the rudder has taken effect, the ship slips in a path which is approximately circular with the bow just inside the ship's path and the stern just outside it. In this condition the ship appears to be pivoting around a point from $\frac{1}{6}$ to $\frac{1}{3}$ the length of the ship from the bow (fig. 10.1). The definitions of certain maneuvering terms are illustrated in figure 10.1.

TYPE	APPROACH SPEED (knots)	RUDDER ANGLE (degrees)	RADIUS (yards)	90° TURN		180° TURN		STEADY TURNING	
				Time (seconds)	Speed (knots)	Time (seconds)	Speed (knots)	Time to reach constant speed (seconds)	constant speed (knots)
Battleship	15	15	600	165	11	320	10	255	10
		35	400	135	9	255	7	210	7
	25	15	600	110	17	200	17	120	17
		35	385	85	15	160	12.5	160	12.5
Cruiser	15	15	550	140	12	275	11.5	180	11.5
	32.5	35	350	100	9.5	205	9	120	9
Carrier	15	15	785	90	27	165	27	75	27
		35	415	60	23.5	110	20.5	105	20.5
Destroyer	15	15	525	150	10.5	270	10	180	10
	25	35	360	110	9	220	8	150	8
PT Boat*	25	15	545	95	18	170	17.5	105	17.5
		35	375	70	16	140	13.5	120	13.5
PT Boat*	25	15	580	75	24.5	145	24.5	30	24.5
		30	320	55	20.5	95	20.5	50	20.5
PT Boat*	32	15	795	80	30	155	30	40	30
		30	435	55	27	100	27	40	27
PT Boat*	25	35	100	16	—	28	—	—	20
		35	120	10	—	22	—	—	25

*Data not complete for this type.

Figure 10.2. (Added.) Table showing maneuvering characteristics of naval vessels.

46.4. RADII OF TURNS. The radius in which a ship of a given type will turn depends on the speed of approach and the rudder angle used, and indicates the minimum amount of sea room needed for a maneuver. The table in figure 10.2 shows average radii of turns for different types of warships. The speed loss in the turn is also shown, as well as the time required to turn 90° and 180°. When steady turn conditions are established, the speed in turn and the rate of turn become constant. The table shows the resulting constant speed after a steady turn as well as the time required to reach this speed. When equipped with twin rudders, however, naval vessels increase their maneuverability over the figures shown in the tables.

46.5. OTHER CHARACTERISTICS. The following points concerning naval vessels should be noted:

a. Naval vessels are able to fire while maneuvering and their accuracy is only slightly impaired.

b. When fired upon, naval vessels invariably can be expected to maneuver. A common evasive action is maneuvering into the splash to offset the effect of fire adjustment.

c. After a maneuver has been completed, the vessel will continue on a straight course for a period of time. A vessel normally will not maneuver on a sinuous course except while on convoy duty.

d. The evasive action of a submarine is to "crash dive." The average time required to crash dive is only 35 seconds.

e. Small vessels, such as DD's and MTB's, may combine maneuver with the use of smoke, either for their own protection or for the protection of larger units. Planes or, when wind is favorable, the large vessels themselves may use smoke. Even without accurate dead reckoning behind smoke, the enemy's navigation may be unimpaired because of his use of radar.

66. General conclusions as * * * of vessels follow:

* * *
d. A hit with * * * out of action. Unarmored vessels can * * * weapon within range.
* * *

73. (Superseded.) In connection with the discussion in this chapter the following terms are defined:

a. *Fire direction* is the exercise of tactical command of one or more fire units in the selection of targets and concentration or distribution of fire on them at appropriate times.

b. *Fire control*, also called *conduct of fire*, consists of all operations connected with the preparation and actual application of effective fire upon a target; the unit that normally exercises fire control is the gun battery.

Section II. DIRECTION OF FIRE AGAINST WATER-BORNE TARGETS

FACTORS AFFECTING DIRECTION OF FIRE

78. It may be * * * to seacoast artillery. In this connection, **direction** of seacoast artillery fire

against the enemy's fleet will be influenced by the extent of knowledge about the following:

* * * *

III. The *gun battery* * * * gun batteries include:

a. The *antimotor torpedo boat (AMTB) battery*, a special purpose gun battery normally manning 90-mm guns, for primary employment against motor torpedo boats and for secondary employment against aircraft.

b. The *antiaircraft battery*, a special purpose gun battery, normally manning 90-mm or 120-mm AA guns for primary employment against aircraft.

143. (Superseded.) Hostile vessels that are to be used for blocking purposes must be sunk before they reach the point where their blocking mission can be effected. Vessels appearing to be friendly may be used by the enemy in blocking attacks. Such vessels are often unarmored. In defense against blocking attacks, all available armament should be massed against any vessel capable of executing a blocking mission as soon as the vessel is detected, unless recognition or identification as friendly is prompt and positive.

Section II.1. (Added.) EMPLOYMENT OF AMTB ARTILLERY

147.1. **GENERAL.** AMTB problems, arising from the characteristics of motor torpedo boats and the resultant types of fire employed against them, require special attention. The MTB, with speeds

up to 50 knots, low silhouette, and about a 4-foot draft, is able to turn 180° within a period of 25 seconds and operate in very shallow water. It is usually equipped with navigational radar and devices for radar countermeasures (RCM), and carries a relatively large amount of offensive and defensive armament which may include torpedoes, depth charges, machine guns, automatic weapons, rockets, and smoke generators. The large amount of explosive carried and the light construction of the MTB warrant the belief that one direct hit from a 90-mm gun is enough to put an MTB out of action.

147.2. THE ATTACK. An MTB attack is usually designed to strike some specific object. Such an object is generally so important that the attackers will use as many boats as they deem necessary to insure destruction of the objective. MTB attacks can be expected under any condition of visibility but most probably when visibility is poor and when atmospheric conditions permit the use of smoke. Regarding its attacking force as expendable, the enemy will push home the attack determinedly and in many instances create diversions simultaneously with the attack.

147.3. THE APPROACH. a. MTB's have a comparatively short range of action and are built more for speed and maneuverability than seaworthiness. If the object of an MTB attack is a long distance from an enemy base, the attacking craft will probably be transported to a rendezvous

by some type of carrier disguised as a neutral or friendly ship.

b. Having been dropped by the carrier, the MTB's usually proceed slowly and quietly toward the objective until discovered. To avoid defensive surveillance radar, MTB's may follow the shoreline as closely as possible or may run in the trough of the sea. If a searchlight illuminates attacking craft during their approach, they may turn head-on into the light to reduce their observable reflecting area and escape detection. It is more probable, however, that the MTB's will lay smoke in which to maneuver and escape the light.

147.4. EVASIVE ACTION. a. When closely engaged, MTB's usually take evasive action. The tactics employed in this maneuvering will depend largely on the features of the waterway, the disposition of the defending armament, and the MTB mission. MTB's will attempt to make predictions extremely inaccurate by sharp and irregular changes of course.

b. If an MTB is illuminated by searchlights, and the range is not too great, the attackers will try to shoot out the lights. At ranges up to 1,000 yards, MTB's stand an excellent chance of success against the lights. If a large number of MTB's are engaged in the attack, some boats may be assigned the mission of proceeding close to shore to shoot out the searchlights that are in action or, if the weather conditions are favorable, to lay smoke to blind the defenses.

c. Diversions may take the form of destroyer attacks, bombing attacks of all levels, ground strafing, or any combination suitable to the mission being performed.

d. Although nets, booms, floating logs and other obstacles harass and restrict the operation of MTB's, they must not be regarded as effective barriers. A well-briefed enemy attack will include plans for surmounting or destroying these obstacles. Therefore, the proper defense is a sufficiently strong and well trained organization of armament, able to meet and destroy an MTB attack by gunfire alone.

147.5. RADAR TRACKING. When it is possible to track an MTB with a fire control radar, good data must be obtained as quickly as possible. The enemy may carry radar intercept receivers which will inform him that he is being surveyed by radar, thus alerting him to take evasive action. As soon as good data are obtained, fire for effect should begin.

147.6. ILLUMINATION. When illumination of targets within 5,000 yards is necessary, and when the battery is ready to fire, both spread-beam and concentrated-beam searchlights may be used. Under excellent conditions of visibility, targets can be tracked with a height finder and spread-beam lights to about 3,500 yards; with concentrated-beam lights to about 5,000 yards. If it is necessary to search for the target with a single light, the fire control instruments should follow

the searchlight beam so that at the instant the target is illuminated tracking can commence. When the target is illuminated, firing should begin as soon as possible after a reasonably reliable range is determined. It is better to open fire quickly at an approximate range than to hold fire awaiting an accurate range.

147.7. TARGET ATTACK. A large number of MTB targets will present additional problems to the AMTB defense. In order to take under fire as many targets as possible, a four-gun battery may be split into two firing units; or, more rarely, two-gun batteries or two-gun firing units may be broken into units of one gun, if necessary. When the guns of a battery are firing at different targets, the fire unit engaging the most dangerous target will employ the standard fire control system. The other unit or units will resort to alternate fire control methods. The AMTB commander at the moment of attack must make an instantaneous and sound decision, and must act decisively and quickly.

147.8. METHOD OF FIRE. The rapidity of fire for AMTB engagements requires modification of some of the seacoast fire adjustment methods. Although direct hits are sought using a projectile with a point detonating fuze, the evasive action of MTB's make straight course predictions relatively ineffective. Fire may be placed on the target in a "rocking" pattern, keeping the target bracketed continuously by shifting the center of the pattern with the maneuvering target.

147.9. SUMMARY. The control of AMTB batteries will be dictated by the local situation and will be prescribed by SOP's covering AMTB armament. In view of MTB capabilities and probable tactics, defensive armament should place great fire power on these targets quickly and possess great flexibility of fire control to cope with multiple targets. Plans have to be made for the illumination of small water areas during multiple target attack maneuvers. The basic consideration in dealing with MTB's is the rapidity with which an attack develops once the hostile MTB's realize they are detected. Speed in obtaining and disseminating intelligence is important, and a simple system for the assignment of targets and for the shifting of fire from one target to another must be developed.

151. Functions of **controlled** submarine mines are to:

* * * * *

g. (Added.) Close possible routes of approach which are not adequately covered by gunfire.

153. The term "obstacle" * * * to shore defense. They may be used to completely close harbor entrances unnecessary for friendly vessels, to bar direct approach to channels, or to force adoption of formations or movements unfavorable to the attack and favorable to the defense, **or to restrict the entrance to a harbor in order to facilitate the control and the identification of surface vessels.**

CHAPTER 5.1 (Added)

LANDWARD FIRING

Section I. GENERAL

220.1. GENERAL. a. Fixed seacoast artillery. The power of fixed seacoast artillery and the ability of its installations to withstand strong sea and air attacks generally deter direct seaborne frontal attack against the area it defends. A capable and determined enemy, unwilling to risk such frontal attack, can be expected to attempt to secure a desired harbor or base by land operations conducted initially out of range of the most effective fires of the seacoast artillery. If hostile ground forces succeed in coming within range of this artillery, its landward firing capabilities *must* be exploited to the *maximum* to support the ground defense and to influence the action consistent with the accomplishment of its seaward mission.

b. Mobile seacoast artillery. Mobile seacoast artillery may be employed for landward firing under a variety of conditions. As part of an amphibious force of all arms, it may be employed initially in support of the land operations, taking up a seaward defense mission later. When mobile seacoast artillery comprises a temporary seaward defense, it may be employed in its seaward defense positions to support land operations still being conducted. When not emplaced for seaward

defense, it may be employed exclusively as field artillery. When attached or assigned to fixed seacoast defenses, it participates in and supplements the landward firing missions of the defenses.

220.2. PRINCIPLES OF EMPLOYMENT. The basic principles governing the tactical employment of field artillery are applicable to the employment of seacoast artillery in landward firing. These principles are covered in FM 6-20 and other field manuals of the 6- series. Every seacoast artilleryman must be thoroughly familiar with these principles and with the tactics and techniques of the infantry-artillery team. The following discussion is limited generally to matters requiring special consideration in the employment of seacoast artillery in landward firing resulting from its special characteristics.

220.3. ROLE IN LANDWARD DEFENSE. Essentially, harbor defenses constitute strong points in the coast defense system.

a. The seacoast artillery commander charged primarily with maintaining a seaward defense of a harbor or base is also responsible in peacetime and immediately upon the outbreak of hostilities for the landward defense of his harbor defense or base, within the range limits of the armament assigned, and his plans must be made based upon a continuing survey of the troops actually at his disposal and on the various factors ultimately considered in an estimate of the situation (par. 456). For the planning phase, a study should be made of the Joint Action of the Army and Navy.

b. After hostilities have been in progress, the ground defense of a harbor or base will be conducted usually by a field force composed of infantry, armor, artillery, and other arms in accordance with the principles in FM 100-5. Seacoast artillery then acts in conjunction with other artillery in a supporting role under the artillery commander of the field force when functioning in the landward defense role. The command functions of the seacoast artillery commander in this instance deal with the execution by the seacoast artillery of the field force commander's decisions as expressed by the artillery commander.

220.4. PLANNING. a. When a harbor defense is operating under the overall command of a field force commander responsible for coast defense, the seacoast artillery commander is responsible for making a continuing estimate of the situation and recommendations to the higher commander for the effective employment of the seacoast artillery in landward actions. He is also responsible that plans based on the decision of the responsible commander are formulated and that all necessary preparations to implement the plans are made.

b. Plans and orders will include provisions for observation, intelligence, liaison, communications, tactical organization, and coordination with other arms and services, particularly the Navy. They should also include contingent conditions, such as operating without field artillery or other arms present.

Section II. EMPLOYMENT

220.5. CONTROL AND COORDINATION OF FIRES.

In supporting ground forces in defensive combat, a high degree of control and coordination of artillery fires is essential, especially to shift or mass fires on critical targets or areas at critical times. This is accomplished mainly by holding the artillery under centralized control. Owing to certain differences in characteristics and technical methods of fire between seacoast and field artillery, control of seacoast artillery is best centralized through its own fire direction centers.

220.6. FIRE DIRECTION CENTERS FOR SEACOAST. a.

Seacoast artillery command post procedure requires some reorganization to set up a fire direction center for landward firing due to—

(1) The fact that landward fire may be observed and adjusted by an observer of some other arm.

(2) The lack of sufficient communication facilities between firing batteries and each observer who might require fire.

(3) The necessity for rapid, rigid control and coordination of artillery fire on a high command level.

b. Seacoast artillery fire direction centers will generally be of two types, the battalion level or field artillery type, and the harbor defense or divisional type.

(1) In the battalion fire direction center, operation follows field artillery procedure as much as possible, computing data and adjusting fire in

such a manner as to be applicable to seacoast armament.

(2) In the harbor defense fire direction center, however, no target assignment in terms of range or azimuth is usually made, nor is fire adjustment attempted at this level. The harbor defense fire direction center normally assigns targets by map or grid coordinates, and permits the battery or the battalion fire direction center under it to compute the firing and adjustment data. Mobile seacoast armament usually operates under the battalion fire direction center, and fixed seacoast armament operates under a harbor defense fire direction center.

220.7. TYPES OF EMPLOYMENT. a. Owing to its characteristics—long range, immobility, and limited landward fields of fire due to casemating or siting—fixed seacoast armament is most suitably employed in general support missions.

b. However, the type of employment may be influenced by other considerations, such as the amount of other artillery available, the amount, kind and siting of additional seacoast artillery, and the tactical situation. When the amount of seacoast artillery capable of landward firing is limited and little or no field artillery is present, the seacoast artillery will be employed to serve the defense as a whole. When insufficient field artillery is available for needed reinforcement of the fires of direct support artillery, suitably sited seacoast armament may be assigned reinforcing missions. While the use of suitably sited minor caliber armament as direct support artillery is not

precluded should the need arise, such employment would be exceptional.

Section III. OBSERVATION

220.8. GENERAL. a. Fixed seacoast artillery capitalizes on its permanent locations to select, survey, and prepare observation posts, and to plan and organize, as far as possible, the necessary communications in advance of emergencies. Observation, however, must remain flexible, capable of maneuver, and able to function under deteriorated conditions.

b. Seacoast artillery landward observation is normally organized to serve the seacoast artillery as a whole. Therefore, the primary responsibility for its coordination and maneuver is retained by the seacoast artillery commander.

c. Seacoast artillery landward observation must be coordinated with the observation of other arms; this coordination consists chiefly in making these observation posts available and submitting their visibility charts to other arms. Personnel of field artillery and other arms may observe and adjust the landward fires of seacoast artillery, and seacoast artillery observation personnel may do likewise for other artillery.

d. Observation, especially for long-range seacoast artillery, must be pushed forward as far as possible. Observation deep into the hostile position generally will require favorable terrain for bilateral observation, or the use of air force high-performance aircraft or liaison type aircraft.

e. Observation must be continuous and complete. If withdrawal or displacement becomes

necessary, continued close surveillance of critical sectors should be planned.

220.9. OBSERVATION POSTS. Principles governing the selection of observation posts are given in field manuals of the 6- series. Positions will be selected which provide complete observation of the defensive sector to the required depth. Alternate and withdrawal positions will be selected for use when initial positions become untenable. Survey operations are performed at each position to determine the location of the observation post and the azimuth to a suitable reference point which will insure accurate orientation of observing instruments. To check on the effectiveness of observation, visibility charts are prepared for each position and a composite chart is prepared to reveal visibility dead spaces or other deficiencies. Observation posts are numbered serially for reference purposes.

220.10. OBSERVERS. a. **General.** An artillery observation post should be manned by a detail of not less than three men (FM 6-101). Observation must be continuous and complete; suitable reliefs will be provided for each post actually manned.

b. **Personnel selected.** Observers with adequate training and experience in gunnery are better fitted for landward firing adjustment and spotting than men without such training and experience.

c. **Training.** Good observers are trained in the observation and adjustment of fire, the tactics and technique of the infantry-artillery team, the

interpretation and use of maps and aerial photographs, in the use of observation and communications equipment, and in the terminology of terrestrial fire adjustment. Initial training in observation and adjustment of fire can be conducted with miniature ranges on the field artillery trainer M3 (TM 6-225), and can be followed by actual experience in observation of landward fire. It is also essential that observers participate in tactical exercises to familiarize themselves with the operation of the defense as a whole.

Section IV. INTELLIGENCE

220.11. COLLECTION OF INTELLIGENCE. *a.* In order to serve the defense as a whole, seacoast artillery will make provisions for obtaining information of the enemy from each sector of the defense. All available means are used.

b. The principal seacoast artillery means for obtaining information, when large field forces are *not* defending the sector, are observers in forward positions. Information is routed to the seacoast artillery landward fire direction center covering the sector reported on as directly as possible. Since the organization of this intelligence collection is supported almost solely by the personnel immediately under the command of the seacoast artillery commander, SOP's will cover all the necessary instructions well in advance of emergencies.

c. The principal seacoast artillery means for obtaining information, when large field forces are defending the sector, are observers in forward

positions and liaison officers sent to front line units. This personnel does not always come from the harbor defenses, and additional plans have to be made by the seacoast artillery commander, in coordination with the field force artillery commander, to organize the landward firing observation for seacoast artillery.

d. The S-2 section of the fire direction center gathers the information from available sources, evaluates it, and disseminates it to subordinate, adjacent, and higher echelons.

Section V. LIAISON

220.12. LIAISON OFFICERS. A certain number of seacoast officers, in addition to those listed on T/O & E's, must be trained to act as liaison officers with units of the field force. Liaison officers with messengers and communications personnel are sent to the command posts of supported units and of artillery units whose fires the seacoast artillery reinforces. Such additional liaison is established with front line units as may be required. Liaison officers are used advantageously to supervise groups of observers. They may also observe and adjust fires when necessary. The duties of liaison officers are covered in detail in FM 6-101.

220.13. OBSERVERS. Seacoast artillery observers sent forward will establish contact with nearby front line units. Intelligence from observers may be routed directly to seacoast artillery fire direction centers, or may go through a liaison officer located at the nearest field command post.

Section VI. FIRE DIRECTION

220.14. TACTICAL ORGANIZATION. In landward firing, as in seaward firing, a tactical organization for combat must be adopted for the efficient coordination and maneuver of fires (par. 220.6). The extent to which subordinate groups or battalions in the seaward defense organization are employed for landward fire direction, or provisional subordinate landward fire direction centers organized, is dependent upon a number of factors. These include a consideration of which batteries are capable of landward firing, their respective landward capabilities and fields of fire, signal communications, and the amount of field artillery present. No fixed rules can be given. The guiding principle is that batteries (battalions) having common missions are grouped. The number of subordinate fire direction centers should be held to the minimum consistent with effective control. They should correspond, where practicable, to the seaward defense organization, since this facilitates reversion to seaward defense. In small harbor defenses, or when only a limited number of batteries are capable of landward firing, the harbor defense landward fire direction center is usually the only one required. Elements of the seaward defense tactical organization not utilized during landward firing continue to maintain the seaward defense.

220.15. FIRE DIRECTION CENTERS. a. The landward fire direction center of the harbor defense preferably is located adjacent to the harbor defense operations-intelligence section to utilize the

personnel of this section and to facilitate reversion to a seaward defense role. The seacoast artillery commander should locate his command post at the fire direction center (unless required to locate at the command post of the force commander). The same considerations apply to subordinate fire direction centers.

b. Fixed seacoast artillery fire direction centers seldom compute firing data for the firing batteries. Preparation of landward firing data is covered in FM 4-10 (when revised). See FM 6-40 concerning fire direction centers for field artillery.

c. The basis for all fire direction is the landward firing chart. It is a composite of the battery firing charts (see FM 6-40 and 4-10 when revised) and should be accurate with respect to grid coordinates. Even when the landward fire direction center has no responsibility for preparing firing data for individual gun batteries, it is desirable for the chart to be sufficiently accurate to permit the location of targets by polar coordinates when azimuth readings can be obtained from two or more observers.

d. The S-2 function in the fire direction center is to obtain information of the enemy from all available sources. The S-3 function is to plan the fires that will most effectively support the field force. Ordinarily, S-3 is authorized to order fire in accordance with the policies and plans of the seacoast artillery commander. In all of these operations, staff sections will be guided by the tactical doctrine and technique contained in Field Artillery manuals covering similar operations.

Section VII. SIGNAL COMMUNICATION

220.16. COMMUNICATION PLAN. The communication plan for landward firing must be developed to meet the needs of each particular location. Factors affecting the plan include the terrain, the number of observers required, the amount of artillery involved, the communication equipment available, and the combat situation. Due to the varying requirements of different harbor defenses, no standardized plan can be prescribed. The communication system should provide for communication between—

- a. Observers and landward fire direction center.
- b. Observers and batteries.
- c. Observers and liaison officers.
- d. Liaison officers and landward fire direction center.

220.17. WIRE COMMUNICATION. a. Wire communication for landward firing utilizes the seacoast artillery fire control telephone system and a field wire telephone system. The seacoast artillery system is permanently installed (ch. 13) and provides for two or more protected circuits from the landward fire direction center to each battery. The field wire system is not installed ordinarily until the need for it develops. Necessary wire and equipment must be assembled for emergency use and communication details must be trained in the rapid establishment of the field wire system in accordance with the communication plan.

- b. The requirements of the communications plan may be met usually by installing field switch-

boards at each liaison officer's position and connecting these switchboards by trunks to the nearest seacoast artillery fire control switchboard. Observation parties may carry light reels of field or assault wire for laying individual lines from the nearest liaison officer's switchboard to the observation post to be occupied. To minimize the amount of wire to be laid, maximum use should be made of commercial lines where suitable and available. Radio communication is substituted for wire communication only when the use of wire circuits becomes impractical.

220.18. RADIO COMMUNICATION. a. Fire control. Suitable radio sets will be given to observers that are adjusting fire for communication with batteries or the fire direction center if wire communication becomes impractical. Separate frequencies should be assigned, if available, to each observation detail for fire control purposes. Normally the observer's receiver is kept tuned to the seacoast artillery command frequency. When the observer is assigned an adjustment mission, he switches to his fire control frequency. If the unit or fire direction center radio set is limited to four crystal-controlled frequencies, additional crystals must be supplied to permit netting with the various observation posts.

- b. **Intelligence.** When telephone communication becomes impractical, observers use radio to transmit intelligence reports to the fire direction center. Several observers ordinarily will be assigned to use the same intelligence transmitting frequency. When an observer has an intelligence

report to transmit, he switches from his fire control frequency to his assigned intelligence frequency. The use of several intelligence frequencies requires that the S-2 keep a receiver in operation for each frequency in order to receive any reports that may come in.

Section VIII. SPECIAL CONSIDERATIONS FOR MOBILE SEACOAST ARTILLERY

220.19. METHODS TO BE USED. The methods to be used by mobile seacoast artillery in conducting landward firing are determined by the manner in which these units are employed.

a. Harbor defenses. If the mobile armament is assigned to a permanent harbor defense to reinforce the seaward fire power of the defense, it is necessary for the guns to be oriented and coordinated with the seaward fire control system of the harbor defense. Usually, the guns are emplaced to permit 360° traverse. In this situation, the mobile batteries will make preparations and use methods similar to those of the fixed batteries.

b. Temporary harbor defenses. If mobile seacoast artillery (battalion or group) is given the mission of organizing a temporary harbor defense, as at an oversea base, it is necessary for all guns to be oriented from a common point. To facilitate employment in landward firing, the reference point selected for orientation should be the same as that used by field artillery in the area. The grid coordinates of the seacoast artillery landward firing charts should also coincide with the grid used by the field artillery. As long as the

seacoast artillery has responsibility for seaward defense, preparations for and methods used for landward firing should be the same as if the mobile armament were in a permanent harbor defense.

c. Field artillery roles. When mobile seacoast artillery units are relieved of their seaward defense missions and are employed as heavy field artillery, they will employ field artillery methods and technique as prescribed in the 6- series field manuals, particularly FM 6-40. In this situation, field artillery sights, fire control equipment, and other necessary equipment should be issued.

d. Special situations. Mobile seacoast artillery batteries emplaced for seaward defense as in **a** or **b** above may, in an emergency, be ordered to occupy supplementary positions from which more effective landward fire can be delivered. The decision as to whether or not to change over to field artillery equipment is governed by the situation. If field artillery is present, the mobile seacoast artillery should be employed as reinforcing artillery and should use field artillery methods. If no field artillery is present, the seacoast artillery commander will have to exercise centralized control over his units and thus can choose that method or combination of methods which will best accomplish the mission. To aid in simplifying the problem, all necessary preparations for firing should be completed for each supplementary position selected for possible occupation.

220.20. ORGANIZATION. a. Gun battery. When mobile seacoast artillery units are employed as field artillery, the gun batteries should be equipped with necessary items of field artillery equipment, and the personnel should be reassigned duties appropriate to the field artillery role. Figure 17.1 shows a type of manning table which can be used to organize a mobile seacoast artillery battery for employment as field artillery. Figure 17.2 shows how a 155-mm gun Coast Artillery battery might be reorganized to conform with the organization of a 155-mm gun Field Artillery battery.

b. Battalion. The field artillery battalion is organized to include a service battery and a headquarters battery in addition to the gun batteries. In mobile seacoast artillery, the battalion headquarters battery performs the functions of both the service battery and the headquarters battery. Experience in using mobile seacoast artillery as reinforcing field artillery indicates that this consolidation of duties is not objectionable in field operations; therefore, organization of a separate service battery is not recommended. Comparison of the T/O & E for the 155-mm seacoast artillery gun battalion headquarters and headquarters battery with field artillery T/O & E for similar units indicates that it is possible to duplicate the field artillery sections and details with the personnel available in the seacoast artillery unit. Figure 17.3 shows how this is accomplished.

O INDICATES ASSIGNMENT OF INDIVIDUALS FROM MOBILE SEACOAST ARTILLERY TYPE BATTERY, BELOW, TO FIELD ARTILLERY TYPE BATTERY, SHOWN AT RIGHT.

[illegible]

Figure 17.1 (Added.) A type of manning table for reorganizing mobile seacoast artillery batteries for Field Artillery missions.

224. Conditions under which * * * which will exist:

* * *
f. (Added.) Limited transportation and engineering equipment. The solution of * * * forceful troop leading.

226. In preparation for * * * embrace the following:

* * *
c. Land firing and fire adjustment, use of forward observers and air observers, and liaison with ground troops.

* * *
237. Searchlights are classified * * * the harbor defense.

Mobile searchlights are those that are used with mobile seacoast artillery. When mobile seacoast * * * at all times. The general considerations for employment of searchlights listed in the following paragraphs are applicable to both permanent and **mobile** lights.

259. Effective employment of searching lights requires that a definite sector, the limits of which have been determined and prescribed, be assigned to each light. These limits **may be** determined by well-defined features, such as islands, or by limiting azimuths for each light.

266. Rescinded.

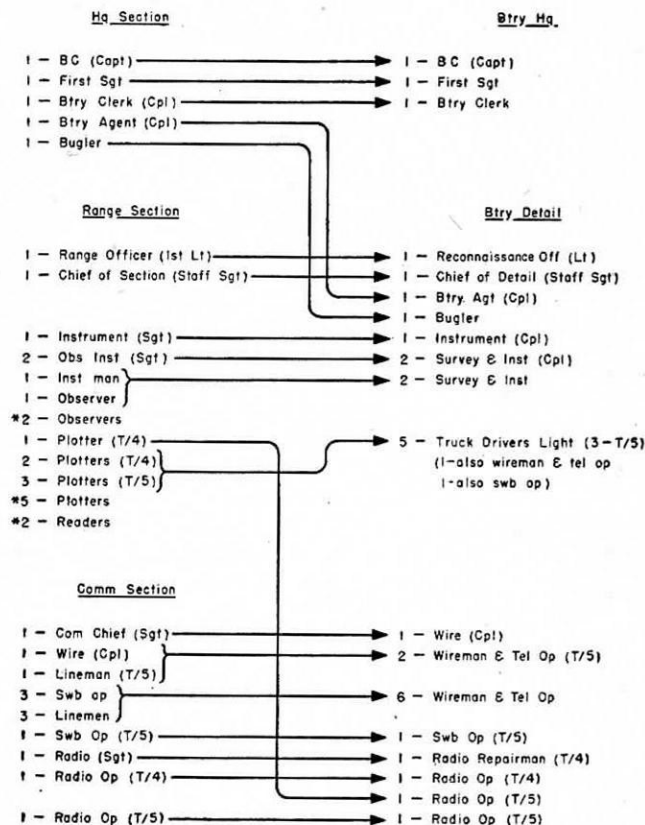
269. (Superseded.) The control station operator and the searchlight operator each have a tele-

155-MM CA BATTERY

(T/O & E 4-157)

155-MM FA BATTERY

(T/O & E 6-357)



Note: No Basics shown

* Required in CA only

Figure 17.2. (Added.) A chart showing a plan for temporary reorganization of a 155-mm C. A. battery to function as Field Artillery.

Btry Detail

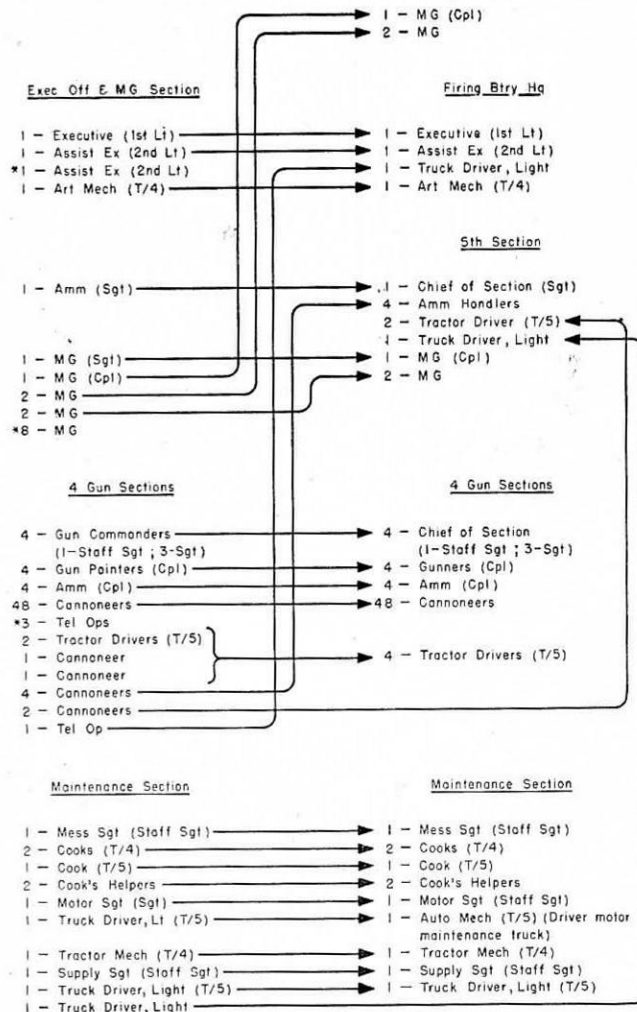


Figure 17.2—Continued.

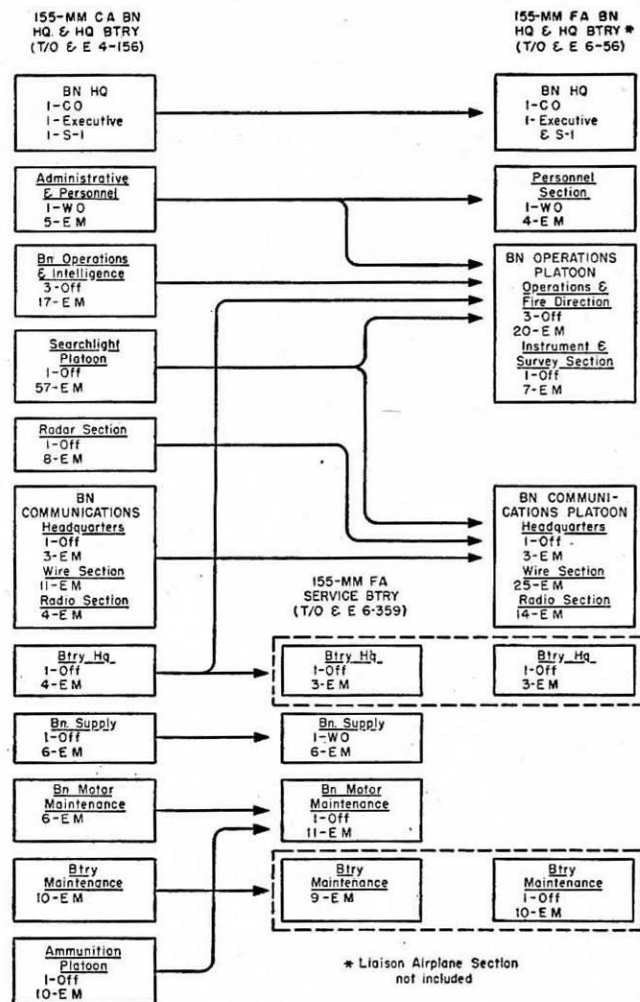


Figure 17.3. (Added.) A chart showing a plan for temporary reorganization of a 155-mm C. A. battalion headquarters and headquarters battery to function as Field Artillery.

phone connected to the command line from the searchlight switchboard (fig. 49.1); thus, both receive the commands from the searchlight officer. The light commander, who usually positions himself at the light, can use the searchlight operator's telephone to give commands to the control station operator and to talk with the searchlight officer.

270. (Superseded.) The light commander is responsible for the operation of his searchlight even though the control station operator receives commands direct from the searchlight officer. The control station operator is addressed as, "____ controller," thus: TWO CONTROLLER. Commands employed in operation and control of searchlights and their meanings are given in appendix IV.

271. Rescinded.

272. Rescinded.

273. Rescinded.

276. (Superseded.) General information regarding characteristics, operation, and siting of sea-coast artillery radar equipment is given in this section; information concerning the capabilities of radar sets is contained in appendixes X and XI.

277. The primary missions * * * radar equipment are:

a. To detect and locate enemy and friendly surface vessels and low-flying aircraft.

* * * * *

281. AREA SITING BY HIGHER HEADQUARTERS. (Superseded.) To insure adequate and coordinated surveillance of a defended area, higher headquarters specifies the approximate location of surveillance-type radar sets only. As the location of armament dictates the general area in which the fire control radar sets are sited, battery commanders normally site these sets. To select the area for each surveillance radar set, a detailed study is necessary. The following factors are considered:

a. **Type of equipment available.** The characteristics and capabilities of the equipment are considered first. These include the amount and the weight of the equipment, its mobility, and its maximum calibrated range.

b. **Number of sets available.** The number of surveillance sets available determines degree of coverage, overlap, and the possibility of avoiding clutter and dead areas.

c. **Tactical situation.** The relative importance of the various defended points should be determined. Then, a review should be made of the capabilities of the enemy with regard to the types of equipment he may employ and directions from which he can attack.

d. **Capabilities of defending forces.** The capabilities of the seacoast artillery units are considered together with the disposition and capabilities of other defending arms and forces.

e. **Discrimination characteristics.** Where the area to be defended contains harbors which lie in inlets, coves, or bays, the range and azimuth discrimination characteristics of a radar set may cause excessive clutter areas. Clutter is at a minimum when the radar beam strikes shorelines approximately perpendicularly. Sites should be avoided from which the radar beam looks obliquely along shorelines, especially if the shorelines are rugged. In general, a radar set should be sited at the entrances to inlets, coves, and bays, or on small islands which are seaward of such entrances.

f. **Enemy radar countermeasures.** The probability of enemy radar countermeasures in any major attempt to penetrate a defended area makes necessary the siting of radar sets so as to minimize the area that can be obscured by any single jamming station. Although a single jammer may affect several stations when their antennas are pointed in its direction, the resultant loss of surveillance can be confined to a small area by siting sets so that, in the vicinity of any point that an enemy jammer might occupy, the beams of at least two radars cross at nearly right angles.

g. **Warning nets.** Where sufficient radar equipment is available, radar sets can be used most effectively by integrating them into a warning net under the control of the highest seacoast artillery headquarters present in the area. In some situations, especially along extended shorelines and chains of islands, such warning nets are almost a necessity. Warning nets are particularly effective against enemy jamming operations.

h. Coordination with other arms and forces.

Coordination of seacoast surveillance equipment with the radar equipment manned by other arms and forces in the same area is necessary to reduce to a minimum the interference between adjacent sets and to insure a closely knit system of surveillance.

281.1. SITING BY BATTALION AND BATTERY.

(Added.) Following the designation of areas for the siting of subordinate unit surveillance equipment, battalion radar officers must make detailed studies of these areas to select the exact sites. Studies by battery officers for siting fire control radar equipment involve the same considerations; the only difference is that the area for siting is determined by the location of the battery armament. The following factors are considered:

a. Characteristics of equipment available. The characteristics (such as pulse length, beam width, and maximum range) will help determine the best site for a radar set, either surveillance or fire control. Minimum clutter and dead areas are desirable. Fire control radar sets must be able to furnish range and azimuth to a target anywhere in the field of fire of the battery to which it is assigned.

b. Height of site. Since height of site is a principal governing factor of the maximum range of a radar set, a map reconnaissance of the given area (supplemented by ground reconnaissance, if possible) is one of the first tasks for the radar officer. If ground elevations within the siting area do not provide sufficient height of site, increased

height of the antenna tower probably will be necessary.

Note. In the trade wind latitudes when radar sets have a height of site less than 50 feet, guided propagation (app. XI) materially increases range. In such an area, sites approximately 50 to 100 feet above sea level often give less satisfactory performance and should be avoided. These factors should be considered as it may be desirable to site a radar set below 50 feet above sea level even though higher sites are available.

c. Local defense. In order to take advantage of every possibility of gaining increased range of detection, surveillance sets should be placed as far out in the probable direction of enemy approach as is consistent with security. Provisions for adequate local defense for such sites must be made even though the sites are removed from the vicinity of the parent organization's control.

d. Location of armament. In the siting of fire control radar sets, it is advisable to place them as close as possible to the armament which they serve. Reducing displacement to a minimum facilitates communications and positions the radar equipment where maximum use can be made of its spotting capabilities.

e. Secondary assignment. In addition to a fire control set being sited to cover the field of fire of the battery to which it is assigned, it may be sited also to cover the field of fire of at least one other battery as a secondary mission.

f. Accessibility. Many factors govern the degree of accessibility of a radar site. These factors include the time available for siting, mobility, ability to install and maintain communications, and ability to resupply the radar equipment with

the necessary quantities of replacement parts, fuel, and oil. The accessibility must be much greater where time is limited; conversely, where permanent radar sites are being selected and time is no factor, the importance of accessibility is greatly reduced.

g. External factors affecting radar performance. Special consideration should be given to the external factors affecting radar performance. These factors include obstructions, absorptions, sources of secondary reflections, spurious echoes, ground contours, and fixed echoes.

h. Camouflage. In areas where natural vegetation is prevalent, the problem of camouflage is simplified. In such areas, especially in wooded locations, it is desirable to emplace the radar tower in the woods, allowing sufficient height for the antenna to clear the tops of all trees throughout the assigned sector of observation and providing clearance of at least 5° below the axis of the antenna beam when the antenna is in its normal operating position. In areas of little or no vegetation, the requirements for height of site will govern whether or not a tower must be used. If a tower is necessary, it will require the construction of some type of suitable camouflage.

i. Clutter and dead areas. The location and extent of areas in which radar is ineffective or nonoperational can be determined on estimated clutter and dead area charts before installation of the sets, and checked subsequently by operational clutter and dead area charts. It is necessary especially in the location of clutter areas to remember the size of the normal target to be tracked,

since this will govern in part the size of the clutter area.

OPERATIONS

283. SURVEILLANCE SETS. (Superseded.) **a.** Data from the surveillance radar set will flow into the HDCP, or group or battalion CP as the case might be, and there be displayed on an operations map or operations board. If the radar installation is within 1,000 feet of the command post, remote radar indicators may be used to supplement the operations map or board.

b. The surveillance radar set should be sited for best surveillance coverage regardless of its distance from the command post. The data which the radar set provides can be easily transmitted to the command post by telephone or radio.

c. Higher headquarters should promptly obtain actual clutter and dead area charts from each surveillance set installed. With such information, weak points of the radar coverage can be determined and often eliminated by selecting alternate sites for certain sets, or by employing fire control sets to cover the gap.

d. Surveillance radar sets determine target position data in terms of range and azimuth from the radar set. These data normally will be converted to grid coordinates before being transmitted to the operations room. Data in terms of range and azimuth are satisfactory when a single radar station is the only source of data.

284. FIRE CONTROL SETS. (Superseded.) In the face of enemy radar countermeasures, it may be

necessary for higher headquarters to assume control of all radar sets and reassign them to the various batteries, depending upon the area a particular set can cover. The likelihood that higher headquarters may exercise control over fire control radar set assignments necessitates that each fire control set be assigned an alternate or secondary mission and that these alternate or secondary missions be made known to higher headquarters. In order that changes may be made smoothly and quickly, the alternate or secondary missions must be thoroughly covered in SOP's. The battery commander should be informed of any changes in his control over the fire control set.

SECONDARY MISSIONS

285. SURVEILLANCE SETS. (Superseded.) **a. Detection of low-flying aircraft.** All seacoast artillery radar sets provided with a PPI are capable of detecting low-flying aircraft. When surveillance sets are used to furnish information on low-flying aircraft, the data should be transmitted directly to the filter room of the aircraft warning service as well as to the seacoast artillery command post. The seacoast artillery command post will provide for the data to flow to the antiaircraft and AMTB units under its command.

b. Use in surface warning organizations. Seacoast artillery surface warning organizations can be used independently by a theater commander in cooperation with the naval and air forces. When being used to assist the Navy, the data furnished by the surface warning unit should be reported directly to the Navy sector operations room.

When being used to assist the air forces, the information should be supplied directly to the filter center of the air warning system.

(1) The following assistance may be given the Navy:

(a) Plotting positions of enemy mine-laying operations either by air or surface craft.

(b) Guiding surface craft through channels.

(c) Guiding patrol craft to vessels to be examined.

(d) Guiding rescue craft to disabled vessels or planes.

(e) Guiding lighter-than-air craft at night or in bad weather.

(f) Reporting positions of convoys when air search is not available or when radio silence is essential.

(2) The following assistance may be given the air forces:

(a) Warning of enemy air or surface craft attack against friendly vessels.

(b) Indicating positions of enemy and friendly formations as an aid in guiding friendly aircraft to the target.

(c) Furnishing position data to aircraft being used to drop flares to silhouette enemy craft.

c. Use in an assault. During the assault phase of an amphibious operation, a seacoast artillery surveillance radar set, when landed early, may furnish information on low-flying enemy aircraft and enemy vessels of all types.

d. Warning units in a beach defense. Use of these surveillance sets in cooperation with ground troops in a beach defense will permit the employ-

ment of ground troops with a maximum of economy. Proper employment of the radar set can reduce the number of visual observers required. More troops can be held in reserve until the radar set determines the portion of the beach that is threatened. If redeployment or reinforcement by boat is required, the necessary movement can be controlled in darkness.

e. Fire control. Use may be made of the seacoast artillery surveillance sets to direct fire in emergencies if no fire control system is available.

285.1. FIRE CONTROL SETS. (Added.) **a. Surveillance.** When seacoast artillery surveillance sets are not available, or are not available in sufficient quantities to cover the entire area assigned, fire control sets may be used in a secondary role for surveillance. All standard fire control sets have PPI presentations and are satisfactory surveillance instruments at medium ranges.

b. Resolution of multiple targets. Since discrimination between targets by fire control sets is much better than by surveillance sets, the resolution of multiple targets is better. Thus, it may be necessary when attempting to resolve multiple targets with a surveillance set to call upon fire control sets for assistance.

c. Antiaircraft fire control. Sets that originally were designed as antiaircraft fire control sets, but were modified to become suitable as seacoast artillery sets, may still be used as antiaircraft fire control sets in a secondary role. When a set is used in this secondary role, the data

should be transmitted from the set to the antiaircraft director by the proper data cables.

RADAR COUNTERMEASURES

286. GENERAL. (Superseded.) Radar equipment, like radio equipment, is subject to jamming and deception by the enemy. However, a jamming station (which is highly directional) will not affect operation of a radar set in all directions to the same degree that it will affect radio equipment. This is due to the highly directional characteristics of radar sets. Since radar detection depends upon the reflection of a radar signal from a target, the return signal is very small in amplitude, thus making radar equipment much more susceptible to jamming and confusion from one direction than is radio equipment. Personnel responsible for radar employment must be constantly on the alert for countermeasure activities and must be kept informed of the various enemy countermeasure practices. Also, radar personnel must know how to combat any countermeasures that the enemy may use. (See TM 11-750 and TM 11-751.)

286.1. TYPES OF RCM. (Added.) **a. Electronic jamming.** Electronic jamming is of three types, "spot," "barrage," and "moonshine." Spot jammers are confined to a single frequency and are used with monitors so that the jammer can be placed exactly on the frequency to be jammed. Barrage jammers cover a frequency band generally 10 megacycles in width and are often equipped with automatic lock-on devices which

detect the radar signal and automatically tune the jammer to the correct frequency. "Moonshine" jammers are capable of detecting radar signals and retransmitting them at such intervals as to simulate numerous targets. Spot and barrage jamming are difficult to apply effectively against higher frequencies.

b. Window jamming. Window jamming falls in the category of confusion tactics and consists of the scattering of a large number of reflecting objects in the air above the area covered by radar. Three different types are used: chaff, rope, and angel. Chaff consists of strips of metalized paper cut to $\frac{1}{2}$ wave length at the frequency to be jammed. Rope consists of about 100 dipoles, $\frac{1}{2}$ wave length long at the frequency to be jammed, suspended by a string from a small parachute. Angel consists of a very light corner reflector, made of aluminum foil, suspended from a parachute. In general, window jamming has little effect on radar sets of higher frequencies.

293. Intelligence sections or * * * and communication personnel. Intelligence training should not, however, be limited to organized intelligence sections and details. Every person in the military service should know and understand the part he must play in the collection and handling of intelligence.

294. Essential elements of * * * of a plan. When announced, the EEI is a request for information and must be analyzed to reveal what evidences of enemy activity have to be discovered to

fulfill the EEI required. These evidences of enemy activity sought after are the indications of the G-2 plans.

296. Enemy information desired * * * range of subjects. No list of indications will be sufficiently complete to fit all situations, but common or basic indications may be used as a guide. A check list covering * * * in appendix V. This serves as an aid in the analysis of the EEI.

317. The Army HECP * * * a warning shot. For the purpose of firing warning shots, one or more batteries of the harbor defense will be designated as "examination batteries," with the added mission of delivering such fire as may be directed by the HECP. At his discretion * * * defenses are alerted.

328. Observers' reports are * * * the order listed:

*	*	*	*	*
b. Type, and if obtainable, nationality?				
*	*	*	*	*
e.l. (Added.) Speed?				
*	*	*	*	*

329. Observers' reports should * * * expressions as follows:

*	*	*	*	*
b. Type and nationality. Battleships, cruisers, destroyers, * * * or other types. If the nationality of the vessels can be determined, it will follow the type: for example, Battleships, American.				

Where the type * * * through proper training.
(See sec. I, ch. 2.)

* * *
e.1. Speed. (Added.) No estimate of the speed in knots should be made unless the observer is experienced in estimating speeds. A description of "fast" or "slow" will suffice.
* * *

362. The usual principle * * * avenues of approach. These avenues are then covered by heavy fire. Full use is * * * and mine fields. Further information regarding these measures can be secured by reference to FM 5-15 and 5-31.

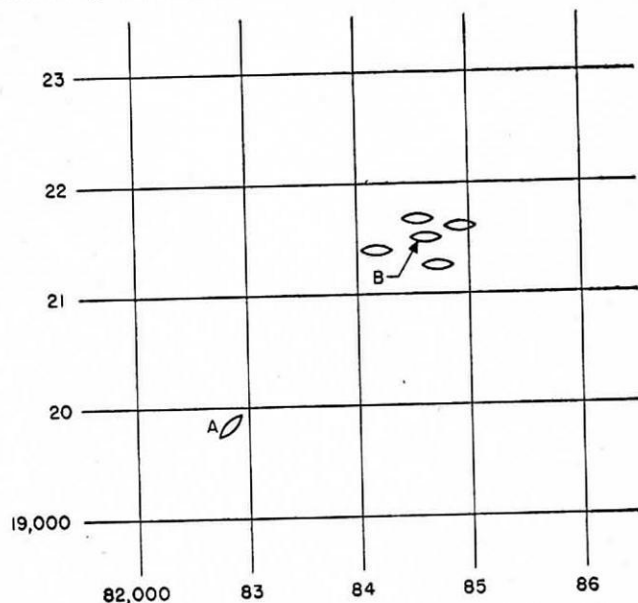


Figure 41. (Superseded.) Locating targets by grid coordinates.

430. (Superseded.) The rapidly changing forms of attack against seacoast artillery require that a fast and accurate means of locating a specific target for all echelons be used. One of the following methods will generally be applicable to any situation:

a. As all elements involved in fire control usually are equipped with a gridded map of the surrounding area, grid coordinates will provide an efficient and accurate method by which elements may locate a target. Figure 41 (superseded) illustrates the grid lines, 1,000 yards apart. As no other vessels are near target A, the coordinate reading (830 — 200) will readily locate it. Such a reading will locate a target within a circle having a radius of approximately 700 yards. A more accurate reading is required to locate target B. The coordinate reading (846 — 215) will easily accomplish its location. A reading of this type will locate a target within a circle having a radius of approximately 70 yards.

b. The location of a target may be described in terms of range and azimuth from a specific point. A fire control element may or may not be located at this point. In figure 40, target A is at azimuth 131°, range 30,000, and target B at azimuth 242°, range 30,000, from Newton Point.

c. For the general location of a target, designated water areas may be used. This is especially applicable to small harbor defenses in which the elements are relatively close together. Thus, target A in figure 39 would be indicated by the command: TARGET: BEACH LEFT, and target B as TARGET: TEAK.

COMMUNICATION WITH RADAR INSTALLATIONS

(Added)

484.1. SURVEILLANCE RADAR SETS. Surveillance information should be transmitted from the radar station to the command post under which the station is operating. Radar data will be transmitted by telephone, radio, or remote indicators. An example of the integration of surveillance radar communication in the harbor defense's communication system is shown in figure 47.1.

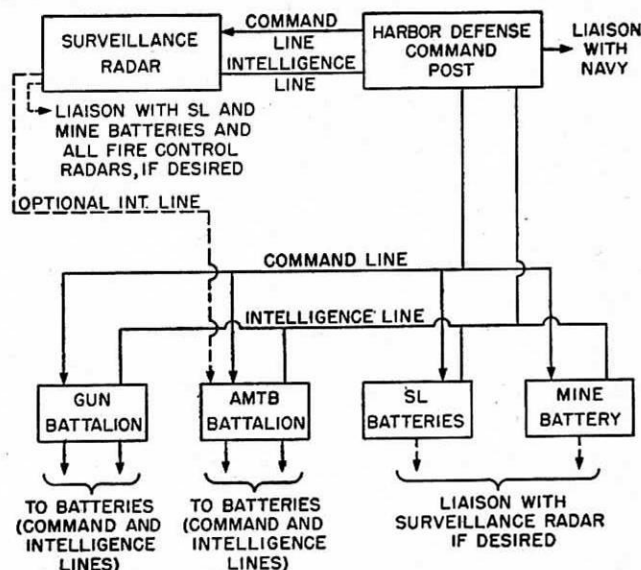


Figure 47.1. (Added.) An example of the communication system of a small harbor defense showing the integration of the surveillance radar communication.

484.2. FIRE CONTROL RADAR SETS. a. Since the transmission of fire control data must be much more accurate and continuous than surveillance data, data transmission systems are commonly used. A typical communication system of this type is included in figure 47.2.

b. The radar sets AN/MPG-1 or AN/FPG-1 transmit fire control data by a voltage-divider-type data transmission system. Under these conditions, the communication system may require a total of nine pairs of lines between the plotting room and the radar set. Of these nine pairs, one is for the command line, two are for the readers' telephones, four are for the automatic transmission of data to the gun data computer, one is for time-interval signals, and one is for a post tele-

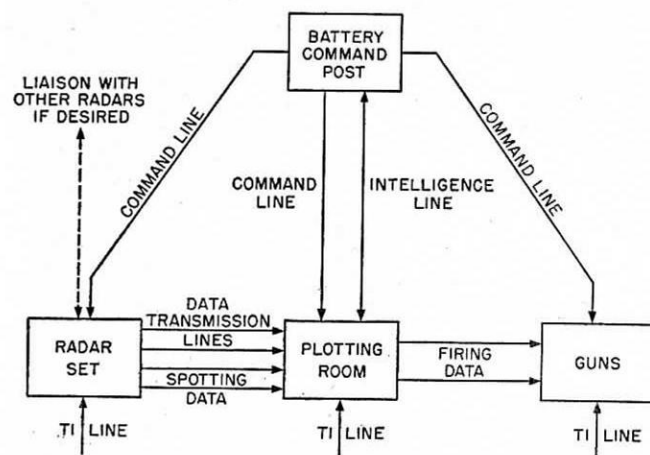


Figure 47.2 (Added.) Example of a communication system using a fire control radar with mobile guns.

phone. If the set is to supply spotting data, two additional lines will be required. Where lines are at a premium, the two readers' telephones may be superimposed on the data transmission frequency. If the time-interval signal is of audio frequency, it may be superimposed on the readers' lines.

c. When used in an AMTB battery, the radar set SCR-584 automatically transmits data over special cables to the director M9. When used to furnish data for a 155-mm gun battery, it employs a selsyn-repeater-type data transmission system with a data box at the point where data are to be used. The data box may be separated from the radar set as much as 450 feet since this amount of cable is provided. In addition to this cable, a minimum of three pairs of telephone lines is required for range and azimuth synchronization, transmission of spotting data, and commands.

[In figure 48, change "T.I. to SCR-296" to "T.I. to radar."]

490. The field telephone equipment used in fire control systems of mobile seacoast artillery units is described and regulations for its installation, operation, and maintenance are given in FM 24-5 and 24-20.

493. As discussed in * * * designed to provide:

b. (Superseded.) Direct communication si-

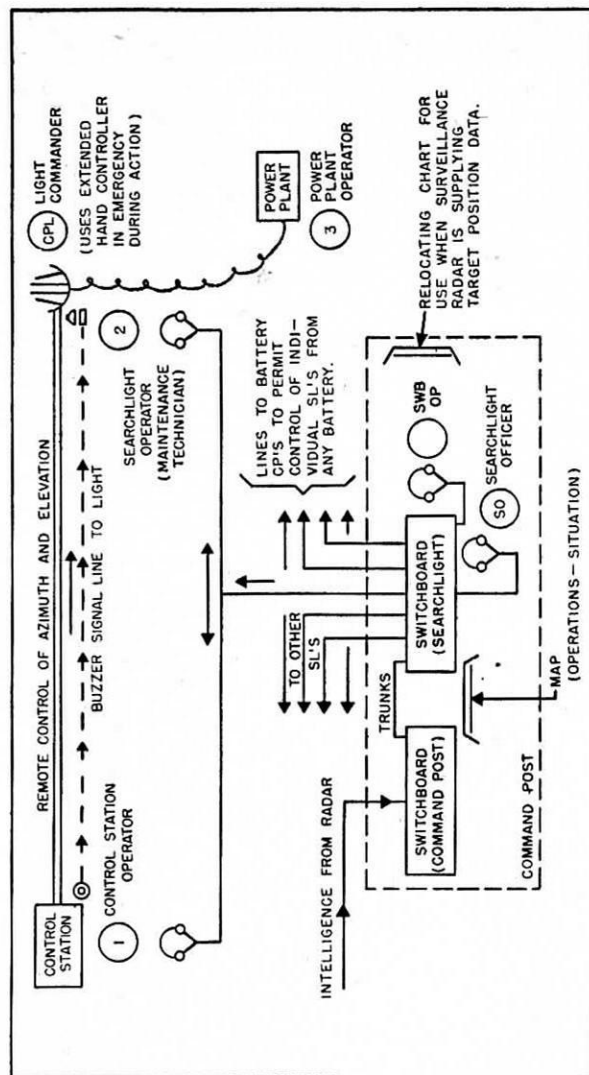


Figure 49.i. (Added.) Searchlight communications.

multaneously between the searchlight officer and any desired number of searchlight positions (lights and control stations).

c. Switching facilities and * * * or all lights.

This flexibility is * * * is normally located. Trunks then connect this switchboard with the switchboards serving **that command post** and other command posts and observation stations. Communication between each * * * the distance permits. **Figure 49.1** schematically illustrates a typical searchlight communications plan.

497. Rules governing radio communication in tactical nets of the Army and between the Army and the Navy are contained in **CCBP 3-2**.

When in contact * * * should be enforced.

APPENDIX II

TYPE DESIGNATIONS, U. S. NAVAL VESSELS AND OTHER CRAFT

Principal Combatant Types

* * * * *

DD Destroyer
DE Escort vessel
SS Submarine

Minor Combatant Types

* * * * *

PG Gunboat
SC Submarine chaser
PT Motor torpedo boat

Naval Auxiliaries

* * * * *

AK Cargo ship
AKA Cargo ship, attack
AO Fuel oil tanker

* * * * *

ARD Floating drydock
AV Seaplane tender
AVD Seaplane tender,
destroyer
PF Frigate

Transports and Landing Craft (Superseded.)

AP Troop transport
APA Attack transport
APH Transport for evacuation of
wounded
APD Destroyer transport
APV Aircraft transport
LCA Landing craft, assault
LCC Landing craft, control
LCF Landing craft, flak
LCI Landing craft, infantry

LCI(L) Landing craft, infantry (large)
 LCM Landing craft, mechanized
 LCP Landing craft, personnel
 LCP (R) Landing craft, personnel
 (ramped)
 LCS Landing craft, support
 LCS (R) Landing craft, support (rocket)
 LCT Landing craft, tank
 LCT (R) Landing craft, tank (rocket)
 LCV Landing craft, vehicle
 LCVP Landing craft, vehicle-personnel
 LSD Landing ship, dock
 LSM Landing ship, medium
 LSM (R) Landing ship, medium (rocket)
 LST Landing ship, tank
 LVT Landing vehicle, tracked
 LVT (A) Landing vehicle, tracked
 (armored)
 DUKW Amphibian truck, 2½-ton, 6 x 6

APPENDIX V **INDICATIONS FOR USE IN ANALYSIS OF** **ESSENTIAL ELEMENTS OF INFORMATION** **(EEI)**

The following check list is intended as a guide
 in listing the indications desired in the analysis of
 the EEI's:

* * * * *

APPENDIX VII (Superseded) CHARACTERISTICS OF RADIO SETS

Unit No.	Type signals	Range miles	Frequency MC	Power source	Communi- cates with SCR—	Approx. weight, in use (lbs)	Remarks	Typical uses
SCR-177-B	CW Tone Voice	100 70 30	0.4-0.8 and 1.5-4.5	Gas eng. gen. and 12-v. btry.	188, 536, 543, 593, 694	1,000	Suitable for ground-air communi- cation. Transport- able	Tactical net of higher echelons: Sector, Sub- sector, HDCP
SCR-188-A	CW Tone Voice	100 70 30	1.5-12.5	Gas eng. gen. and rectifier or 115- or 230-v., 60-cy., a.c.	177, 536, 543, 593, 694	1,385	Suitable for ground-air communi- cation. Transport- able	Used tacti- cally by units requiring more power than the SCR-543
SCR-536	Voice	1	3.5-6.0	Self-contained dry cells	177, 188, 543, 593, 694	5.5	Short-range, lightweight, two-way radio set. 1 preset channel	Shore patrol, survey par- ties, mine yawls.

SCR-543	Voice	30	1.68- 4.45	Gas eng. gen. or 115-v., 60-cy., a.c.	177, 188, 536, 593, 694	919	Has remote control. Ground or vehicular use. Suitable for ground-air communi- cation	Command and air- ground set for HD, battalions, and long- range gun batteries; also, for mobile artillery
SCR-593	Voice	..	2.0-6.0	Storage battery	177, 188, 536, 543, 694	30	Receiver only. Pack and vehicular	Reception of alert or warning messages by AMTB and AA batteries
SCR-694-C	CW Tone Voice	30 20 15	3.8-6.5	Hand gen. or vehicular btry. and vib. power supply	177, 188, 536, 543, 593	108	Ground set suitable for lower echelon nets	Searchlight and observation stations

CHARACTERISTICS OF RADIO SETS—Continued

SCR-808	Voice (FM)	15	27.0-38.9	Storage btry. or 115- to 230-v, a.c.	828	330	4 preset FM channels. 2 receivers	In plotting rooms for receiving base-end data (Works with SCR-828 in observation stations)
SCR-828	Voice (FM)	15	27.0-38.9	Storage btry. or 115- to 230-v, a.c.	808	284	Same as SCR-808 less 1 receiver	Base-end stations and forward OP's for data trans-mission (Works with SCR-808 in plotting room)

APPENDIX VIII

FORM 3 (Superseded)

COMMANDER'S ESTIMATE OF THE SITUATION FOR SEACOAST ARTILLERY

I. MISSION. This is a statement of the artillery mission and its purpose. In estimating the situation, first consider your mission as set forth in orders or instructions received from higher authority, or as deduced from instructions and knowledge of the situation. Your mission is the controlling factor of the estimate.

2. SITUATION AND COURSES OF ACTION. a. Considerations affecting the possible courses of action. Determine and analyze these factors of the situation which will influence your choice of a course of action as well as those which affect the capabilities of the enemy.

(1) Characteristics of the area of operation.

(a) Terrain and water areas (including friendly observation and surveillance, the fields of fire, dead areas, cover and concealment, probable areas for attack, off-shore soundings and tides, shoals, currents, landing beaches, landing craft assembly areas, surf, exits from beaches, paratroop landing areas and avenues of approach for ground troops).

(b) Weather and climate (fog, visibility, prevailing winds and how they may affect the accomplishment of your mission and the capabilities of the enemy).

(c) Communication facilities available to you.
(d) The political, economic and psychological factors which will affect civilians and troops and aid or hinder the accomplishment of your mission, or that of the enemy.

(2) Relative combat power.

(a) Enemy strength and composition.

(b) Friendly strength and composition.

(c) Disposition of both enemy and friendly troops.

(d) Mine fields, controlled and free; nets, booms, and obstacles.

(e) Supply and evacuation (present status of supply, especially Classes I and IV; method to be used for replacement; methods to be used for evacuation, military and civilian, and for traffic control).

(f) Reinforcements, friendly and enemy (including strength, composition, expected time of arrival, state of training and effect on the accomplishment of the mission).

b. Enemy capabilities. Consider the lines of action which the enemy is physically capable of adopting and which will interfere with the accomplishment of your mission. Since it is very dangerous to make assumptions as to the enemy's intentions, all of his capabilities must be considered even if you note the enemy's most likely line of action. Enemy capabilities that may affect a seacoast artillery mission include:

(1) Naval action: reconnaissance, raids, bombardment, mine laying, attacks on mine fields and obstacles, blocking attacks, submarine and MTB attacks on shipping, penetration.

(2) Landing attack: minor raid or major landing.

(3) Air action: reconnaissance, bombing, low-level attack, landing of airborne troops.

(4) Attack by ground troops.

(5) Organized civilian disturbances.

Include only the capabilities applicable to the situation and affecting you directly.

c. Your possible lines of action. Next, consider your lines of action which, if successful, will accomplish your mission. Normally there will be several lines of action. In listing the possible lines of action for a seacoast artillery mission, consider the applicable factors of the following list:

(1) Locations of mobile elements whose locations are not already established: such as batteries, radar sets, OP's.

(2) Allocation of troops to various missions: such as beach defense, interior guard, artillery roles.

(3) Alert status.

(4) Effect on other elements: naval, air, and ground forces; civilian traffic; commercial shipping.

3. ANALYSIS OF OPPOSING COURSES OF ACTION. Determine the probable effect of each enemy capability on the success of each of your own courses of action. In this paragraph, each of the courses of action promising success in accomplishing your mission is separately compared with every capability of the enemy which may adversely affect accomplishment.

4. COMPARISON OF OWN LINES OF ACTION.

Compare each of your possible lines of action against the capabilities of the enemy and consider the probable results in each case. The advantages and disadvantages of each possible line of action, with respect to interference by the enemy, are thus determined. Some lines of action will be eliminated immediately. Carefully compare and weigh those remaining before making your decision.

5. DECISION. Select the line of action that appears to be most favorable and announce it as your decision. The decision should be as comprehensive as available time permits. Under any conditions, make the decision clear enough to constitute the basis of action for your entire command.

Note. A commander's estimate may vary from a short, almost instantaneous, mental estimate, to a carefully written document requiring hours of preparation and the collaboration of various staff officers. A commander will make use of the several staff estimates, such as the estimates of the enemy, operations, supply, and personnel situations. The final decision is always made by the commander. A standard form for estimates of the situation will appear in a revised FM 101-5.

* * * * *
FORM 8
SUGGESTED CHECK LIST FOR STANDING
OPERATING PROCEDURE FOR ALL
SEACOAST ARTILLERY UNITS

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FORM 9
SUGGESTED CHECK LIST OF ADDITIONAL
ITEMS FOR STANDING OPERATING PRO-
CEDURE APPLICABLE TO MOBILE
SEACOAST ARTILLERY UNITS

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APPENDIX IX (Added) PLANS

Most harbor defenses have numerous plans on hand to cover unusual situations and occurrences. Listed below are those generally necessary and common to most harbor defenses (additions and deletions to this list may be required by the local situation) :

Antiaircraft Defense Plan.
Antimechanized Defense Plan.
Beach Defense Plan.
Destruction and Demolition Plan.
Disaster Relief Plan.
Evacuation Plan.
Fort Damage Control Plan.
Hospitalization Plan.
Joint Naval District and Harbor Defense Plan.
Land Defense Plan.
Plan for Support of Service Command Troops in Defense of Fixed Service Command Installations Outside Harbor Defenses.
Protective Mobilization Plan.
Seacoast Artillery Defense Plan.

APPENDIX X (Added)

CAPABILITIES OF SEACOAST ARTILLERY RADAR SETS

The following data are approximate dependable ranges of detection by radar sets at various heights of site for normal conditions of operation. For fire control sets, there is also listed the approximate range at which splashes from *high-explosive* shells can be detected.

SCR-682-A

Height of site (feet)	Range (yards)		
	MTB	Destroyer	Cruiser
100	19,000	24,000	30,000
200	24,000	32,000	42,000
300	30,000	40,000	50,000
400	35,000	48,000	60,000
1,000	40,000	60,000	75,000

AN/MPG-1

Height of site (feet)	Range (yards)			
	MTB	Destroyer	Cruiser	Splash
50	15,000	25,000	30,000	6 in. — 20,000 8 in. — 24,000
100	21,000	30,000	35,000	6 in. — 28,000 8 in. — 28,000

SCR-584-A and -B

Height of site (feet)	Range (yards)			
	MTB	Destroyer	Cruiser	Splash (155-mm)
50	12,000	20,000	25,000	15,000
100	19,000	24,000	30,000	17,000
200	24,000	32,000	42,000	21,000
300	30,000	40,000	50,000	24,000
400	35,000	48,000	60,000	30,000

APPENDIX XI (Added)

METEOROLOGICAL EFFECTS ON RADAR PERFORMANCE

1. GENERAL. Meteorological conditions have a pronounced effect on radar detection ranges. Seacoast artillery radar sets have tracked convoys on some occasions to 100 miles beyond normal radar ranges. The same radar sets a few hours later may have failed entirely to pick up targets clearly visible to the eye. Therefore, serious errors and false evaluations of radar representations may result if the effect of weather and atmosphere are not considered. *The effect of weather on radar detection ranges increases with an increase in the frequency of radar transmissions.*

2. REFRACTION. *a.* An increase or decrease in radar detection ranges over that possible by straight line transmission indicates that bending must take place. This bending, or refraction, is a property of light. The quantity that determines refraction is called the index of refraction. Refraction occurs whenever there is a change in the index of refraction at the boundary of two mediums (such as different layers of the atmosphere), and when the radar wave traveling from one medium to another strikes the second medium at an oblique angle. The index of refraction of the

atmosphere changes with height because of the variations with height of temperature, pressure, and moisture content.

b. The atmosphere does not consist of distinctive layers; rather the changes in its physical properties, and hence its index of refraction, are gradual. Thus, the change in direction of radar waves is gradual. Radar waves passing through the lower atmosphere usually bend downward. Since the atmosphere is a very tenuous substance, the amount of refraction is very small and in no case exceeds a fraction of a degree. These small effects influence the line propagation of the radar beam when the angle between the radar beam and the horizontal is very small. Since in all seacoast artillery operations this angle is small, a bending of the radar beam can be considered normal.

3. PROPAGATION. Under average weather conditions the radar detection range is increased about 15 percent beyond the distance to the optical horizon. This phenomenon is known as *standard propagation*. Wave propagation deviating from the standard occurs under special weather conditions, and for those cases where the radar detection range is increased; this condition is called *guided propagation*. The main feature of guided propagation is a pronounced bending of the radar beam toward the surface of the earth. This pronounced bending is due to refraction and occurs in the layers of the atmosphere which are less than 5,000 feet in height. The amount of bending in the regions above this height is almost always of standard propagation. There are

weather conditions which tend to reflect the radar beam away from the surface of the earth, thus reducing the radar detection range to something less than the distance to the optical horizon. Fortunately these conditions exist very infrequently.

4. DETECTION RANGES. Radar detection ranges may be predicted to a certain extent; this prediction is based on the meteorological conditions discussed as follows:

a. Temperature inversion and moisture lapse.

Guided propagation which results in increased radar detection ranges is caused by an abnormal decrease in the index of refraction of the atmosphere with an increase in height. The index of refraction depends on distribution of moisture and temperature in the atmosphere, particularly in those layers a few hundred feet above the surface of the earth. Under normal conditions (standard propagation) the temperature of the atmosphere decreases with height above the surface of the earth at the rate of about 3.6° F. per 1,000 feet. The moisture content of the atmosphere above the surface of the earth under normal conditions also gradually decreases. If, however, the temperature of the atmosphere above the surface of the earth increases with height, a condition exists which is known as temperature inversion. This condition in combination with a rapid decrease of moisture with height (moisture lapse) produces guided propagation.

Note. Temperature inversion, except at low temperatures, will not produce guided propagation unless there is an abnormally high moisture lapse.

b. Subsidence. Another weather phenomenon favorable to guided propagation is subsidence. By subsidence is meant the slow downward motion combined with horizontal movement of air above low layers of atmosphere. This process, which most frequently occurs in high pressure areas, will produce temperature inversion. The subsiding air moreover becomes relatively much drier than the unaffected air below. In general, subsidence takes place at an altitude of from 4,000 to 5,000 feet. Subsidence normally does not affect propagation when the radar set is situated at a low altitude. Lower subsidence areas (1,000 to 2,500 feet) occur along the southwestern coast of the United States and are known to produce guided propagation.

c. Turbulence. Turbulence of the air has a distinct normalizing effect on propagation in that it tends to smooth out temperature and moisture variations. Moderate to strong winds produce a turbulence layer extending usually to an altitude of about 4,000 feet. Under these conditions the air is well mixed and standard propagation exists. Turbulent conditions are usually found in regions of low barometric pressure.

d. Conditions which limit optical visibility. Conditions which limit optical visibility other than darkness affect radar detection ranges in the following ways:

(1) Low-hanging fogs generally indicate conditions of temperature inversion and moisture lapse leading to increased detection ranges.

(2) Heavy rains and snow tend to mask tar-

gets in the field of radar search and reduce radar detection ranges.

5. OCCURRENCE OF GUIDED PROPAGATION.

It is extremely difficult to estimate in general terms the frequency of occurrence of guided propagation since statistical data are almost non-existent except for limited regions in Europe. In the central Mediterranean during the summer months of 1943, guided propagation was observed on 9 days out of 10. In regions where the barometric pressure is generally low and the winds strong, guided propagation is an unusual occurrence.

[AG 300.7 (22 May 1947).]

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OFFICIAL:

DWIGHT D. EISENHOWER
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